REMARKS/ARGUMENTS

Reconsideration is respectfully requested of the Official Action of April 29, 2009, relating to the above-identified application.

The claims in the application are Claims 10 to 21.

Claims 10 and 11 have been amended to incorporate the weight percentage amounts for each of the ingredients of the claimed compositions. The basis is found in the published application at paragraphs [0038], [0046], [0055], [0060] and [0066].

No new matter is presented and, therefore, it is believed that the amendment to Claims 10 and 11 overcomes the rejection under 35 U.S.C. § 112.

The rejection of Claims 10 to 21 under 35 U.S.C. § 103(a) as unpatentable over the U.S. patent of *Hosomi, et al.*, U.S. 7,368,497, taken with *Nakamura, et al.*, U.S. 6,403,221, is traversed and reconsideration is respectfully requested.

The *Hosomi* patent discloses resin compositions that can be used to prepare a prepreg. A laminate can be formed by laminating a metallic foil onto the prepreg and then molding the combination by heat and pressure.

Hosomi teaches that the resin composition should include a first thermosetting resin and a second thermosetting resin. A large number of first and second thermosetting resins are mentioned by *Hosomi* including epoxy resins, phenolic resins, urea resins, melamine resins, silicon resins, polyester resins, cyanate resins and the like. See col. 4, lines 49 to 53. Among the epoxy resins are those mentioned in col. 4, beginning at line 54. Examples of the cyanate resin include those listed in col. 4, beginning at line 62, and continuing on to col. 5. A curing agent such as one of those mentioned in col. 6, beginning at line 59, can be used which includes an

imidazole. Finally, the resin compositions of the reference can also include a filler such as inorganic fillers mentioned beginning in col. 7, at line 46.

Thus, it will be seen that *Hosomi* discloses a myriad of possible combinations and permutations.

It is clear as admitted in the Official Action that *Hosomi* does not disclose the presence of any phenoxy resin.

The Official Action relies on the *Nakamura* patent for a disclosure of an phenoxy resin and states the phenoxy resin of *Nakamura* ". . .is composed of biphenyl-type epoxy resin and bisphenol S-type epoxy resin" and refers to col. 4, line 67, to col. 5, line 1. However, this statement is apparently based on a misunderstanding. A phenoxy resin is not a type of epoxy resin. *Nakamura*'s resin is not composed of an epoxy resin.

Furthermore, the Official Action fails to explain any reason, basis or motivation whereby a person skilled in the art would be led to include the phenoxy resin of *Nakamura* in the composition of *Hosomi*. On page 3 of the Official Action, the allegation is made that ". . .it would have been obvious that *Hosomi's* phenoxy resin is included in the epoxy resin because *Hosomi* clearly teaches bisphenol-type epoxy resin and biphenyl-type epoxy resin. . .". The ultimate conclusion that the resin composition "taught by *Hosomi* is at least the same as the independent claims" is respectfully submitted to in error.

The phenoxy resin of *Nakamura* is <u>not</u> composed of an epoxy and is not the same as the epoxy resin of *Hosomi*. Submitted herewith are the structural formulas showing the difference in structure between an epoxy resin and a phenoxy resin. This information was obtained by a search on Google data base. The two are not the same and consequently, there is no evidence that are are interchangeable or equivalent. Furthermore, there is no suggestion in *Nakamura* that

there would be any advantage or benefit in incorporating the phenoxy resin into the composition of *Hosomi*. Consequently, it is respectfully submitted that the Official Action fails to make out *prima facie* obviousness of the claimed invention and, therefore, the rejection should be withdrawn.

Reconsideration is respectfully requested of the provisional double-patenting rejection of Claims 10-21 in view of Claims 1-17,25 and 28 of copending application 12/085,872. Applicants respectfully submit that the rejection is not well considered.

Claims 10 to 21 of the present application call for, *inter alia*, a resin composition capable of being employed for forming a resin layer on a metal foil and which comprises a cyanate resin and/or propolymer thereof, an epoxy resin substantially containing no halogen atoms, a phenoxy resin substantially containing no halogen atoms, an imidazole compound, and an inorganic filler, all present in well-defined weight percent ranges.

Claims 1-17, 25 and 28 of the copending application are silent as to epoxy resins and phenoxy resins, as well as the features of substantially no halogen atoms in the resins and are entirely lacking with respect to any disclosure as to weight percent ranges of components.

Applicants respectfully submit that the provisional double-patenting rejection should be withdrawn as the claims in this application which has an earlier filing date patentably distinguish from the cited claims of application 12/085,782.

All matters having been taken care of by the foregoing response, applicants request favorable reconsideration at the Examiner's earliest convenience.

Respectfully submitted,

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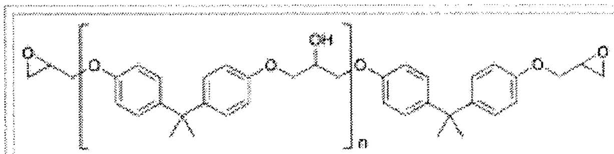
Epoxy

From Wikipedia, the free encyclopedia

Epoxy or **polyepoxide** is a thermosetting polymer formed from reaction of an epoxide "resin" with polyamine "hardener". Epoxy has a wide range of applications, including fiber-reinforced plastic materials and general purpose adhesives.

Contents

Chemistry



Structure of unmodified epoxy prepolymer. *n* denotes the number of polymerized subunits and is in the range from 0 to about 25

Epoxy is a copolymer; that is, it is formed from two different chemicals. These are referred to as the "resin" and the "hardener". The resin consists of monomers or short chain polymers with an epoxide group at either end. Most common epoxy resins are produced from a reaction between epichlorohydrin and bisphenol-A, though the latter may be replaced by similar chemicals. The hardener consists of polyamine monomers, for example Triethylenetetramine (TETA). When these compounds are mixed together, the amine groups react with the epoxide groups to form a covalent bond. Each NH group can react with an epoxide group, so that the resulting polymer is heavily crosslinked, and is thus rigid and strong.[1][2]

The process of polymerization is called "curing", and can be controlled through temperature and choice of resin and hardener compounds; the process can take minutes to hours. Some formulations benefit from heating during the cure period, whereas others simply require time, and ambient temperatures.

History

The first commercial attempts to prepare resins from epichlorohydrin were made in 1927 in the United States. Credit for the first synthesis of bisphenol-A-based epoxy resins is shared by Dr. Pierre Castan of Switzerland and Dr. S.O. Greenlee of the United States in 1936. Dr. Castan's work was licensed by Ciba, Ltd. of Switzerland, which went on to become one of the three major epoxy resin producers worldwide. Ciba's epoxy business was spun off and later sold in the late 1990s and is now the advanced materials business unit of Huntsman Corporation of the United States. Dr. Greenlee's work was for the firm of Devoe-Reynolds of the United States. Devoe-Reynolds, which was active in the early days of the epoxy resin industry, was sold to Shell Chemical (now Hexion, formerly Resolution Polymers and others).

Applications

The applications for epoxy-based materials are extensive and include coatings, adhesives and composite materials such as those using carbon fiber and fiberglass reinforcements (although polyester, vinyl ester, and other thermosetting resins are also used for glass-reinforced plastic). The chemistry of epoxies and the range of commercially available variations allows cure polymers to be produced with a very broad range of properties. In general, epoxies are known for their excellent adhesion, chemical and heat resistance, good-to-excellent mechanical properties and very good electrical insulating properties. Many properties of epoxies can be modified (for example silver-filled epoxies with good electrical conductivity are available, although epoxies are typically electrically insulating). Variations offering high thermal insulation, or thermal conductivity combined with high electrical resistance for electronics applications, are available.[3]

Paints and coatings

"2 part waterborne epoxy coatings" are used as ambient cure epoxy coatings. These non-hazardous, two-part epoxy coatings are developed for heavy duty service on metal substrates and use less energy than heat-cured powder coatings. These systems use a more attractive 4:1 by volume mixing ratio. The coating dries quickly providing a tough, UV resistant, protective coating with excellent ultimate hardness, and good mar and abrasion resistance. They are designed for rapid dry protective coating applications. Ambient cure 2 Part waterborne epoxy coatings provide excellent physical properties in exterior applications. These products have excellent adhesion to various metal substrates. Their low volatility and water clean up makes them a natural choice for factory cast iron, cast steel, cast aluminum applications and reduces exposure and flammability issues associated with solvent-borne coatings. They are usually used for industrial and automotive uses as they are high heat resistant (as latex-based and alkyd-based paints usually burn, thus peel, with slight high heat temperatures).

Polyester epoxies are used as powder coatings for washers, driers and other "white goods". Fusion Bonded Epoxy Powder Coatings (FBE) are extensively used for corrosion protection of steel pipes and fittings used in the oil and gas industry, potable water transmission pipelines (steel), concrete reinforcing rebar, *et cetera*. Epoxy coatings are also widely used as primers to improve the adhesion of automotive and marine paints especially on metal surfaces where corrosion (rusting) resistance is important. Metal cans and containers are often coated with epoxy to prevent rusting, especially for foods like tomatoes that are acidic. Epoxy resins are also used for high performance and decorative flooring applications especially terrazzo flooring, chip flooring [4] and colored aggregate flooring.[5]

Adhesives

Epoxy adhesives are a major part of the class of adhesives called "structural adhesives" or "engineering adhesives" (which also includes polyurethane, acrylic, cyanoacrylate, and other chemistries.) These high-performance adhesives are used in the construction of aircraft, automobiles, bicycles, boats, golf clubs, skis, snow boards, and other applications where high strength bonds are required. Epoxy adhesives can be developed to suit almost any application. They are exceptional adhesives for wood, metal, glass, stone, and some plastics. They can be made flexible or rigid, transparent or opaque/colored, fast setting or extremely slow setting. Epoxy adhesives are almost unmatched in heat and chemical resistance among common adhesives. In general, epoxy adhesives cured with heat will be more heat- and chemical-resistant than those cured at room temperature. The strength of epoxy adhesives is degraded at temperatures above 350 °F (177 °C).[6]

Some epoxies are cured by exposure to ultraviolet light. Such epoxies are commonly used in optics, fiber optics, optoelectronics and dentistry.

Industrial tooling and composites

Epoxy systems are used in industrial tooling applications to produce molds, master models, laminates, castings, fixtures, and other industrial production aids. This "plastic tooling" replaces metal, wood and other traditional materials, and generally improves the efficiency and either lowers the overall cost or shortens the lead-time for many industrial processes. Epoxies are also used in producing fiber-reinforced or composite parts. They are more expensive than polyester resins and vinyl ester resins, but usually produce stronger and more temperature-resistant composite parts.

Electrical systems and electronics

Epoxy resin formulations are important in the electronics industry, and are employed in motors, generators, transformers, switchgear, bushings, and insulators. Epoxy resins are excellent electrical insulators and protect electrical components from short circuiting, dust and moisture. In the electronics industry epoxy resins are the primary resin used in overmolding integrated circuits, transistors and hybrid circuits, and making printed circuit boards. The largest volume type of circuit board—an "FR-4 board"—is a sandwich of layers of glass cloth bonded into a composite by an epoxy resin. Epoxy resins are used to bond copper foil to circuit board substrates, and are a component of the solder mask on many circuit boards.

An epoxy encapsulated hybrid circuit on a printed circuit board.

Flexible epoxy resins are used for potting transformers and inductors. By using vacuum impregnation on uncured epoxy, winding-to-winding, winding-to-core, and winding-to-insulator air voids are eliminated. The cured epoxy is an electrical insulator and a much better conductor of heat than air. Transformer and inductor hot spots are greatly reduced, giving the component a stable and longer life than unpotted product.

Epoxy resins are applied using the technology of resin dispensing.

Consumer and marine applications

Epoxies are sold in hardware stores, typically as a pack containing separate resin and hardener, which

must be mixed immediately before use. They are also sold in boat shops as repair resins for marine applications. Epoxies typically are not used in the outer layer of a boat because they deteriorate by exposure to UV light. They are often used during boat repair and assembly, and then over-coated with conventional or two-part polyurethane paint or marine-varnishes that provide UV protection.

There are two main areas of marine use. Because of the better mechanical properties relative to the more common polyester resins, epoxies are used for commercial manufacture of components where a high strength/weight ratio is required. The second area is that their strength, gap filling properties and excellent adhesion to many materials including timber have created a boom in amateur building projects including aircraft and boats.

Normal gelcoat formulated for use with polyester resins and vinylester resins does not adhere to epoxy surfaces, though epoxy adheres very well if applied to polyester resin surfaces. "Flocoat" that is normally used to coat the interior of polyester fibreglass yachts is also compatible with epoxies.

Polyester thermosets typically use a ratio of at least 10:1 of resin to hardener (or "catalyst"), while epoxy materials typically use a lower ratio of between 5:1 and 1:1. Epoxy materials tend to harden somewhat more gradually, while polyester materials tend to harden quickly.

The classic epoxy reference guide is the *Handbook of epoxy resins* by Henry Lee and Kris Neville. Originally issued in 1967, it has been reissued repeatedly and still gives an excellent overview of the technology. Some basic tips are given here:www.epoxy.com/install.htm (http://www.epoxy.com/install.htm).

Aerospace applications

In the aerospace industry, epoxy is used as a structural matrix material which is then reinforced by fiber. Typical fiber reinforcements include glass, carbon, Kevlar, and boron. Epoxies are also used as a structural glue. Materials like wood, and others that are 'low-tech' are glued with epoxy resin. One example would be the RJ.03 IBIS homebuilt canard aircraft (http://ibis.experimentals.de/). This design is based on a classic wooden lattice structured fuselage and a classic wooden spar, internally stiffened with foam and completely covered with plywood. Except for the plywood covering the wings, everything is glued with epoxy resin.

Art

Epoxy resin, mixed with pigment, is used as a painting medium, by pouring layers on top of each other to form a complete picture.[7]

Wind Energy applications

Epoxy resin is used in manufacturing rotor blades of wind turbine. The resin is infused in the core material like balsa wood, foam, and reinforcing media glass fabric. The process is called VARTM, i.e. Vacuum Assisted Resin Transfer Moulding. Due to excellent properties and good finish, epoxy is most favoured resin for composites.

Industry

As of 2006, the epoxy industry amounts to more than US$5 billion in North America and about US$15 billion world-wide. The Chinese market has been growing rapidly, and accounts for more than 30% of

the total worldwide market. It is made up of approximately 50–100 manufacturers of basic or commodity epoxy resins and hardeners of which the three largest are Hexion (formerly Resolution Performance Products, formerly Shell Development Company; whose epoxy tradename is "Epon"), The Dow Chemical Company (tradename "D.E.R."), and Huntsman Corporation's Advanced Materials business unit (formerly Vantico, formerly Ciba Specialty Chemical; tradename "Araldite"). In 2007 Huntsman Corporation agreed to merge with Hexion (owned by the Apollo Group)[8][9]. KUKDO Chemical is one of the largest epoxy manufacturers in Asia, and recently their capacity has been increased up to 210,000 MT/Y (Korea 150,000 MT/Y, China 60,000 MT/Y and will be increased totally 300,000 MT/Y by 2009). Nanya Plastic also has the capacity of over 250,000 MT/Y (Taiwan and China), which is mostly for captive use. There are over 50 smaller epoxy manufacturers primarily producing epoxies only regionally, epoxy hardeners only, specialty epoxies, or epoxy modifiers.

These commodity epoxy manufacturers mentioned above typically do not sell epoxy resins in a form usable to smaller end users, so there is another group of companies that purchase epoxy raw materials from the major producers and then compounds (blends, modifies, or otherwise customizes) epoxy systems from these raw materials. These companies are known as "formulators". The majority of the epoxy systems sold are produced by these formulators and they comprise over 60% of the dollar value of the epoxy market. There are hundreds of ways that these formulators can modify epoxies—by adding mineral fillers (talc, silica, alumina, etc.), by adding flexibilizers, viscosity reducers, colorants, thickeners, accelerators, adhesion promoters, etc.. These modifications are made to reduce costs, to improve performance, and to improve processing convenience. As a result a typical formulator sells dozens or even thousands of formulations—each tailored to the requirements of a particular application or market.

Cleanup

Vinegar is an effective and safe solvent to clean up tools, brushes, skin, and most surfaces contaminated with epoxy resin or hardener. Acetone can also be used, but it is very volatile and flammable, unlike vinegar. Vinegar is safer for cleaning epoxy resin from human skin than acetone: both liquids will dissolve the resin, but the resin/acetone solution can easily pass through the skin into the bloodstream, unlike vinegar. White vinegar can even clean up epoxy resin that is beginning to cure/harden. One should always avoid getting epoxy on skin. Citrus-based waterless hand cleaners will help to remove fresh resin from the skin. Vinegar and rubbing alcohol can also be effective in removing fresh uncured epoxy from skin. One should then follow with washing with soap and water. DME (Dimethoxyethane) is also a good solvent for epoxy resin and hardener that gives off very little vapor.

Health risks

The primary risk associated with epoxy use is sensitization to the hardener, which, over time, can induce an allergic reaction. It is a main source of occupational asthma among users of plastics.[10]

Both epichlorohydrin[11] and bisphenol A[12] are endocrine disruptors.

According to some reports [13] Bisphenol A is linked to the following effects in humans:

- oestrogenic activity;
- alteration of male reproductive organs;
- early puberty induction;
- shortened duration of breast feeding;

- pancreatic cancer

See also

- Thermosetting plastic
- Plastic

References

1. ^ "Epoxy Chemistry (http://www.csuchico.edu/~jpgreene/m247/m247_ch02/sld023.htm)". http://www.csuchico.edu/~jpgreene/m247/m247_ch02/sld023.htm.
2. ^ "Epoxy Polymers (http://chem.chem.rochester.edu/~chem424/epoxy.htm)". http://chem.chem.rochester.edu/~chem424/epoxy.htm.
3. ^ May, Clayton A. (1987-12-23). *Epoxy Resins: Chemistry and Technology* (Second ed.). New York: Marcel Dekker Inc. pp. 794. ISBN 0824776909.
4. ^ Chips Flooring (http://www.epoxy.com/chip.htm)
5. ^ Quartz Flooring (http://www.epoxy.com/15.htm)
6. ^ Morena, John J (1988). *Advanced Composite Mold Making*. New York: Van Nostrand Reinhold Co. Inc. pp. 124–125. ISBN 0-442-26414-3.
7. ^ McCreight, Tim; Bsullak, Nicole. *Color on Metal: 50 Artists Share Insights and Techniques*. Madison, WI: Guild. pp. 74. ISBN 1893164063.
8. ^ Steve Gelsi, "Huntsman OK's $10.6 bln takeover offer from Apollo's Hexion" (http://www.marketwatch.com/news/story/huntsman-oks-106-bln-takeover/story.aspx?guid=%7B301E4032-F6E5-4137-9AB9-30F7AB65B442%7D), Market Watch, July 12, 2007.
9. ^ Market Participant, "Hexion IPO Creates Way Too Much Debt" (http://www.seekingalpha.com/article/12385-hexion-ipo-creates-way-too-much-debt), June 22, 2006.
10. ^ MayoClinic --> Occupational asthma (http://www.mayoclinic.com/health/occupational-asthma/DS00591/DSECTION=risk-factors) May 23, 2009
11. ^ http://www.research.northwestern.edu/research/ors/pdfs/cbslappb.pdf
12. ^ http://www.sph.emory.edu/PEHSU/html/exposures/endocrine.htm
13. ^ Greenpeace 2006 April Report "health and chemical exposure" (http://www.greenpeace.org/raw/content/international/press/reports/fragile-our-reproductive-heal.pdf)

External links

- Epoxy Resin health hazards (http://www.dhs.ca.gov/ohb/HESIS/epoxy.htm) (California Department of Health Services)
- The chemistry of epoxide (http://pslc.ws/macrog/epoxy.htm), simple to understand

Retrieved from "http://en.wikipedia.org/wiki/Epoxy"
Categories: Organic polymers | Adhesives | Synthetic resins | Thermosetting plastics
Hidden categories: Articles needing additional references from June 2009

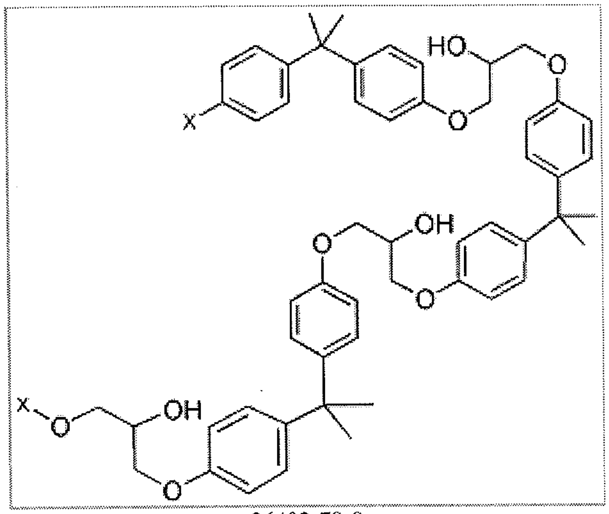
phenoxy resin

Sci-Tech Dictionary: phenoxy resin

(f□'näk·s□ 'rez·□n)

(*organic chemistry*) A high-molecular-weight thermoplastic polyether resin based on bisphenol-A and epichlorohydrin with bisphenol-A terminal groups; used for injection molding, extrusion, coatings, and adhesives.

PHENOXY RESIN Product Description



26402-79-9

CAS No.	**26402-79-9**
Chemical Name:	**PHENOXY RESIN**
Synonyms:	POLY(BISPHENOL A-CO-EPICHLOROHYDRIN) RESIN;PHENOXY RESIN, AVERAGE MW CA. 70,000 (GPC);Phenoxy resin, average M.W. 70000;Polyoxy(2-hydroxy-1,3-propanediyl)oxy-1,4-phenylene(1-methylethylidene)-1,4-phenylene;phenoxy resin 2;PHENOXY RESIN, AVERAGE M.W. 60000
CBNumber:	CB1427255
Molecular Formula:	C54H60O9X2
Formula Weight:	853.05
MOL File:	Mol file

PHENOXY RESIN Property

density :	1.18 g/mL at 25 °C(lit.)
form :	pellets

Safety

Hazard Codes :	T
Risk Statements :	45-20/21/22-36/38-43
Safety Statements :	53-26-36/37-45
WGK Germany :	3

PHENOXY RESIN Chemical Properties,Usage,Production

PHENOXY RESIN Suppliers Global(7)Suppliers BELGIUM 1

Supplier	Tel	Fax	Email	Country	ProdList	Advantage
J & K Chemical Limited	86-10-82848833	861082849933	jkinfo@jkchemical.com	CHINA	28775	70

26402-79-9(PHENOXY RESIN)Related Search:

26402-79-9 POLY(BISPHENOL A-CO-EPICHLOROHYDRIN) PHENOXY RESIN PHENOXY RESIN,

AVERAGE MW CA. 70,000 (GP C) Phenoxy resin, average M.W. 70000 Polyoxy(2-hydroxy-1,3-propanediyl) oxy-1,4-phenylene(1-methylethylidene)-1,4-phenylene phenoxy resin 2 Bisphenol-A Polymers and Epoxy Prepolymer Resins Engineering Polymers Polymer Science C6H44CCH32C6H44OCH2CHOHCH2On PHENOXY RESIN, AVERAGE M.W. 60000